Tropical Diseases due to Microscopic Organisms in the Balkanic Zone.

By ALDO CASTELLANI, M.D., M.R.C.P., Lecturer at the London School of Tropical Medicine; during the War Lieut.-Colonel Italian Medical Service (Naval Branch) and Member of Inter-Allied Sanitary Commission.

(*Read December* 18, 1918.)

ONE PLATE.

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VI.—*Tropical Diseases due to Microscopic Organisms in the Balkanic Zone.*

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I.—Malaria.

Of the diseases to which the Allied troops have been exposed in the Balkans, malaria is by far the most common and the most important. The number of cases of malaria throughout the Adriatic and Balkanic Zones during the years 1915–1917 has been appalling, and the cases of pernicious type quite common. Malaria has been the disease which has caused by far most invaliding among the Allied troops.

Unfortunately during recent years there arose in certain quarters in Europe, and even in tropical countries, a tendency to consider malaria as a not very dangerous disease. The recent experience in the Balkans, therefore, has come as a rude awakening, and has shown what a terrible scourge this disease can be.

The experience in Serbia, Macedonia, and the Adriatic Zone, in addition to showing the frequency and gravity of this malady, has also shown us what a protean disease it is. This of course is nothing new to the old tropical practitioner, but to the young medical man just out from home it is decidedly bewildering. It is especially on these protean features of the malarial infection, on what might be called malarial mimicry, that I should like to say a few words. Malaria may simulate a stupendous number of different diseases.

The Hæmorrhagic Types of Malaria. — Near Skopolje, in Serbia, in September 1915, an outbreak of so-called scurvy was reported as occurring in a Serbian regiment, and I was asked to investigate the condition. The patients were extremely pale, felt very weak and languid, complained of pains in the loins and limbs; in most cases the whole body was covered with petechiæ, and tense indurated swellings due to large extravasations of blood were present in several cases. In many of the patients bleeding was taking place from the gums, which were swollen and spongy, and from the nose; in two cases there were hæmorrhages from the stomach and the intestine; in one there was hæmorrhage from the lungs and bronchi; in another from the kidneys and bladder. The exact diagnosis was most difficult, but the microscope cleared it; the blood was teeming with malarial parasites. In none of the cases was fever noticed, but the presence of a large indurated spleen in two of the patients, and the fact that I had seen similar cases in the Tropics, made me suspect malaria; the blood examinations made soon after revealed presence of malarial parasites. All of the patients were put on quinine, and the symptoms improved in a remarkably rapid manner, and disappeared completely within three to six weeks. In some cases I gave calcium lactate in association with quinine, but I soon found out it was unnecessary. The diet was not changed in any way. This hæmorrhagic type of malaria must be distinguished from the ordinary types of purpura, from scorbutus, also from a peculiar hæmorrhagic affection, without jaundice, of spirochætic origin.

Malaria may simulate *Pernicious Anæmia* Of this type I have seen several cases, both in the Balkans and in tropical countries. The appearance of the patient is quite different from an ordinary malarial cachexia, and there may be no history and no sign pointing to a malarial infection. The patient is generally a young man or woman with the typical pallor and the lemon-yellow tint of pernicious anæmia; in some cases the liver is slightly enlarged, or, more rarely, the spleen; there is no fever, or just 99 or 100° F. at night, which is quite common also in true pernicious anæmia. The blood may be negative for malaria on repeated examinations, and may show most of the common features of pernicious anæmia, such as poikilocytosis, nucleated red cells, high colour index, relative increase of the small mononuclears instead of the large mononuclears, as one would expect in malaria. We had one such case for several months in 1918 at one of the Uskub hospitals. The patient, a Serbian soldier aged twenty-one, was fairly well nourished, but very pale, with a lemon-yellowish tint; he was always very languid and apathetic and stayed in bed the whole time; no fever, no enlargement of spleen or liver. Blood: 2,100,000 red corpuscles, marked poikilocytosis, some nucleated

erythrocytes present; leucocytes, 5000 with a large increase in the lymphocytes (55 p.c.) instead of the large mononuclears, as one would expect in a malarial condition. He was considered to be a case of pernicious anæmia, and accordingly was treated with arsenic for several months, when suddenly one day he had a rigor, the temperature going up to 105° F.; the spleen became just palpable, and a few malarial parasites were found in the blood. A quinine treatment by intramuscular injections was immediately started, and within two months the patient was so improved that he returned to his regiment.

In old individuals the profound anæmia may give rise to the suspicion of internal cancer. A man aged sixty was admitted to Sorowich Hospital, near Monastir, in 1917, in a condition of profound anæmia; he was greatly emaciated, with no fever, no enlargement of the spleen or liver; the dyspeptic symptoms dated from several months; complete loss of apetite, pain after food, and vomiting, which he said was of a very dark colour. The doctor who attended him very naturally suspected cancer, especially as the usual treatment for dyspepsia, dieting, etc., had completely failed. Here, too, the microscope revealed the true nature of the condition. A quinine treatment caused all the symptoms to disappear within a few weeks.

Malaria may simulate *Diseases of the Nervous System. The Polyneuritic Type.*—This type has been denied by many observers, but I have come across a number of cases both in the Tropics and in the Balkans. I would call attention to the type of polyneuritis which simulates wet beri-beri very closely. The patient is œdematous; there is the characteristic gait, knee jerks absent. No fever nor enlargement of the spleen or liver. In two such cases the blood showed Laveran's crescents. They both recovered on quinine given in large doses by the mouth and by intramuscular injection.

The Comatose Type of Malaria, for instance, was quite common in Skopolje and the surrounding districts in Serbia during August and September 1915. In this type the patient is brought into hospital unconscious; he cannot be roused to answer questions. The respiration may be stertorous, or sometimes quiet. The pupils are often contracted, there may be high fever, or the temperature may be normal or subnormal, and in this case a diagnosis of morphia poisoning may occasionally be made. The comatose condition becomes deeper and deeper, and the patient often dies a few hours after admission. The exact diagnosis can be made by microscopical methods.

The Delirious Type.—In this type, of which I have seen seven cases in Skopolje, delirium is the most marked feature; it may be followed by coma and death. These cases have occasionally been confused with alcoholic delirium tremens. The *Cerebrospinal Type*

of Malaria is quite common in the Balkans, and may clinically resemble cerebrospinal meningitis very closely indeed. A patient was admitted to one of the Uskub hospitals in September 1915, with extremely severe headache, vomiting, fever, retraction of head, Kernig's sympton. A diagnosis of cerebrospinal meningitis was made, the patient isolated, and a lumbar puncture performed. The cerebrospinal fluid escaped with higher pressure than normal, but was completely clear. Blood again examined and numerous malaria parasites found. All the symptons disappeared after a few intramuscular injections of quinine.

Malaria may simulate various specific infectious diseases: for instance, Enteric, Malta Fever, Tetanus, Sleeping Sickness, and even Hydrophobia. The typhoid-like type of malaria was far from rare in South Serbia and Macedonia in 1915, and I have again seen similar cases near Monastir; more recently still at Taranto and on the Piave Front. From Gevgheli, on the Greco-Serbian Frontier, it was reported in September 1915 that an epidemic of typhoid had broken out. My friend Dr. Strong, head of the American Sanitary Commission, Dr. T. Jackson, and later on myself, went there, and soon found out that more than 90 p.c. of the so-called typhoid cases were cases of typhoid-like malaria. This type, as a matter of fact, was fairly common also in Skopolje, and numerous cases were admitted to the Lady Paget Hospital in September 1915. In practically all my cases the onset was slow; the patient looked apathetic and complained of headache; tongue very coated; the fever was continuous or subcontinuous; abdomen slightly tumid; spleen generally palpable, but neither very large nor very hard. The patient had certainly all the appearance of a typhoid case. The blood showed as a rule numerous malarial germs, but quinine given in large doses had practically no influence for a long time either on the fever or on the parasites. All the bacteriological examinations for typhoid, paratyphoid, and intermediate germs were, as a rule, negative; very occasionally a case of mixed infection, malaria and typhoid, was found.

Malta Fever Type.—The undulant type of malaria is extremely rare, but it certainly exists. I have seen a case in Macedonia in 1915; the fever, of a typical undulant type, continued many weeks, and was not influenced in the least by quinine 10 gr. t.i.d. given by the mouth for long periods. Malarial parasites were found in the blood repeatedly; all serological and bacteriological examinations for Malta Fever were negative. The fever finally yielded to quinine given intramuscularly.

Tetanus-like Malaria.—I have seen a typical case in Macedonia in 1915, and three in the Tropics, closely resembling lock-jaw. The patient had a normal temperature with trismus, opisthetonus and typical tetanic spasms. In all the cases the blood contained malaria parasites, and an intensive quinine treatment induced a cure.

Hydrophobia-like Malaria.—I was once called by a Ceylonese colleague to see a case which had been diagnosed as hydrophobia. At the time I saw the patient he was in a maniacal condition, temperature 102° F. At the mere sight of water a severe spasm of the larnyx occurred. As he had a large spleen I examined his blood with my portable microscope; it was full of parasites. Quinine caused all the symptoms of hydrophobia to disappear in a few hours. It may possibly have been a case of hysteric hydrophobia syndrome in a malaria patient, though the man was not of neurotic tendency and no hysterical stigmata were present.

Sleeping Sickness Type.—This type of malaria, so far as I know, has never been described. I have seen a case in a tropical country where Sleeping Sickness is unknown. The patient had low fever for months, with slight trembling of the hands and tongue and progressive general weakness; he then became drowsy, and occasionally had convulsions. The blood examination was negative for every known parasite, until many months after the onset of the symptoms a few malarial germs were detected. A course of quinine injections cured the patient. A somewhat similar case, though not so severe, with general debility, tremblings of hands and tongue, very marked drowsiness for several weeks, was seen by Dr. Mitchell and myself in Serbia, but the correct diagnosis in this case was made at once, as the blood was teeming with malaria parasites.

Malaria may simulate various *Diseases of the Digestive System*: for instance, *Dysentery* and *Cholera*. I shall always remember a case with all the symptons of dysentery I once saw in consultation in a tropical country. The patient had been treated with ipecacuanha, anti-dysentery serum, bismuth, salol, nitrate of silver irrigations, etc., for months; the condition very rapidly and completely yielded to quinine within forty-eight hours. Of course one must not forget that there are quite a number of cases of mixed infection—malaria plus bacterial and amœbic dysentery—but the case I have described was certainly not one of these, the examination of the intestinal contents which I made being negative for entamœbæ and other dysenteric germs. I have seen very similar cases also in the South of Italy, in Macedonia and Albania.

Malaria may simulate *Cholera*. During the epidemic of cholera in Ceylon in 1914, I was called to confirm the diagnosis of cholera in a European assistant of one of the big tea firms in Colombo, in order that he might be removed to the Infectious Diseases Hospital, a proceeding the patient strongly objected to and was resisting with what little strength he had left. He had been taken ill suddenly in the night with profuse serous diarrhœa. When I was called to see him at 11 a.m. he was feeling very cold, his skin clammy, his cheeks sunken, and he looked very ill indeed. Temperature, 99° F.; pulse, 104. The stools were absolutely

cholera-like, of the well-known rice-water appearance. Examining the patient I found the spleen just palpable, but very hard. On questioning him I elicited the fact that he had had an attack of malarial fever three weeks previously, on an estate where he had gone for a short holiday. The blood was examined at once; it was swarming with malaria germs. Quinine was given immediately by intramuscular injection, and the diarrhœa stopped within a very few hours. The patient was up two days later. The complete bacteriological examination of the intestinal contents revealed entire absence of the cholera vibrio, or of vibrios of the para-cholera group. A somewhat similar case, which also had been taken for cholera, was seen by me in Northern Macedonia in 1915. This case also recovered very quickly on quinine. Cases of the same nature, though not so typically cholera-like, have been observed by me more recently in Corfu, and at Salonika.

I have mentioned certain internal diseases which may be simulated by malaria, but this infection may even give rise to symptoms pointing to surgical conditions such as appendicitis, acute colo-cystitis, abscess of the cerebellum, abscess of the liver.

A young Serbian soldier was admitted to hospital with symptoms pointing to acute appendicitis: violent pain in the appendicular region, vomiting and fever, but no rigors; severe tenderness and well-marked rigidity all over the right lower abdomen. A surgeon advised operation, and the appendix was removed, but did not appear to be much affected; the temperature fell during the night, and the day after the patient was feeling quite well. On the following day, however, he again complained, greatly to the surprise of the surgeon, of very severe pain in the lower right abdomen, though not so localized. Vomiting set in and the temperature rose to 105. Examination of the blood showed presence of an enormous number of parasites. Quinine given at once by intramuscular injection in large doses made all the symptoms disappear very rapidly.

Another patient in Uskub suffered from very severe headache for months, became nearly blind, had giddiness and vomiting, could hardly stand, and walked like a drunken man. Every night the temperature rose to 100. His medical attendants naturally thought that it might be a case of cerebellar abscess, and operative measures were suggested. However, after repeated examinations the blood was found to contain malaria parasites, and quinine caused a complete cure of the condition.

One could go on indefinitely describing the various strange appearances under which malaria can camouflage itself; but I will now say a few words on the prognosis of the malady.

Prognosis.—In the Balkans, as in any other malarial country, providing an appropriate treatment be given, the prognosis is good in the enormous majority of cases. It must be remembered,

however, that, firstly, in pernicious cases a high mortality may be present notwithstanding an energetic treatment; secondly, in a large number of cases, even of the usual benign type, the cure which is brought about by an appropriate treatment is merely clinical—that is, the patient feels well and shows no signs of the malady, but a complete sterilization is not obtained. The affection remains dormant for months and years, and any cause lowering the resisting power of the individual, such as a chill or a traumatism, may cause the acute symptoms to reappear, and I have known the disease to recur in patients in England ten and fifteen years after leaving the Tropics.

I have mentioned traumatism. An operation—for instance, the simplest surgical act, even a tooth extraction—may re-awaken a very old dormant malarial infection; the patient shortly after has a rigor, the temperature rapidly rises to 104° or 105° F., very severe vomiting sets in—symptoms which may cause a very great deal of anxiety to the surgeon, who, naturally, may be very far from thinking of malaria.

And now a word on the *treatment*. It seems to me that every person proceeding to a malarious zone should know something about how to deal with acute malarial cases when medical help is not at hand: and this is often the case in many tropical districts. On the treatment of malaria one could speak for hours, but it may be condensed into one word, and that word is—quinine.

Every tropical practitioner is, of course, familiar with the colonial patient who will earnestly assure him that quinine not only does not cure malaria, but is the true cause of it. Notwithstanding this "dictum," however, quinine is the only drug that cures the disease, only it must be given—and taken—in large doses. I have said "taken" purposely: the patient must be convinced that it is not sufficient to look at the bottle—one must drink the bitter dose.

In malarious countries quinine may be given in 10-gr. doses three or four times daily to adults, without any danger. It should be given by the mouth in ordinary cases; by intramuscular injection in severe cases; intravenously in the pernicious forms. The injections should, of course, be given only by a doctor.

There are two methods of prophylaxis—the one based on anti-mosquito measures; the other based on the preventive administration of quinine. There has been a great deal of discussion as to which is best; in my opinion both measures should always be employed together. If we have several weapons with which to fight an enemy, it seems to me good policy to use all of them instead of one only. As regards anti-mosquito measures, the destruction of all larvæ by oiling every pool and pond near the military camps, hospitals, etc., is by far the most useful; mechanical protection by means of mosquito-nets and masks should also

be carried out. Of masks I prefer the one invented by Mrs. M. Simpson, called the "Simpsonette." Chemical preparations to keep off mosquitoes are advantageous—the best is citronella oil; on the Piave Front (Italy) every man of the Brigade of which I was for a time in medical charge was supplied with it, and the result was satisfactory. A more pleasant preparation to use, though less effective, is menthol powder. As regards prophylaxis based on quinine administration, the usual dose of 5 gr. daily is utterly inadequate in the Balkans. The daily dose should be increased to at least 8 or 10 gr., and even these doses are at times insufficient to prevent infection.

II.—Typhus.

The microscopical agent of typhus has not yet been found with certainty, though many protozoa and bacteria have been isolated.

The terrible epidemic of this disease in Serbia during the years 1914–1915 will not easily be forgotten. It probably wiped out one-sixth of the entire population, and made havoc especially among doctors and nurses. One-third of the Serbian doctors died of typhus, and a number of victims occurred also among the medical men and nurses of various nationalities, but chiefly British, who had answered the Serbian call for help.

Among these courageous helpers I may perhaps be permitted to mention the name of Lady Ralph Paget. I think no one who was there at that time will ever forget the impression of Lady Paget, a tall, slim figure in the dress of the Red Cross, in the wards of the make-shift subterranean hospital, which was all she had at that time—wards airless, stifling, scarcely lighted, reeking with typhus, and crowded with the dead and dying—ministering to the sick and the wounded, without a thought or a care for her own safety.

A little later Lady Paget's untiring energies succeeded in obtaining the splendid, well-equipped hospital unit which bore her name, and which, with the other fine hospitals opened by the various allied missions, etc., were the means of saving thousands of lives and ending the outbreak. I can testify to the great amount of good these institutions did, having been attached to both the American Red Cross Hospital and the Lady Paget Hospital.

According to my Serbian experience, typhus begins generally abruptly, with pains all over the body, a feeling of prostration, and rigors; but cases in which the onset is slow, somewhat typhoid-like, are far from rare. On an average the duration of fever in my cases was from fourteen to eighteen days. In 80 p.c. of them the fever did not come down by crisis, as usually stated, but by lysis, lasting in general three to five days, and occasionally much longer. Relapses may occur, but are rare. I would call attention to the frequent co-existence of typhus and relapsing fever. This is

explained by the fact that the same insect (louse) carries the two infections. The commonest complications and sequalæ I have observed were, in order of frequency, parotitis, often proceeding to suppuration; gangrene of the feet; polyarthritis; neuritis. Several cases developed during convalescence symptoms of severe depression almost amounting to melancholia.

As regards the prophylaxis of typhus, I am a believer in the efficacy of taking every possible precaution against lice, especially in the sterilization of all soldiers' underclothing and uniforms at fixed intervals, and frequent bathing. As regards the use of various substances which are deleterious to body-lice these are, according to the experiments carried out by Dr. Jackson and myself, and in their order of efficiency: (1) petrol; (2) plain vaseline; (3) guaiacol; (4) anise preparations; (5) iodoform; (6) lysol, cyllin, and similar preparations; (7) carbolic acid solution (5 p.c.); (8) naphthaline; (9) camphor. We found that pyrethrum had a very feeble action, while boric acid, sulphur, corrosive sublimate and zinc sulphate, when used in powder form, had apparently no action whatever. As regards bed-bugs, kerosene oil is the best insecticide. Next to it comes guaiacol. It is interesting and most important to note that an insecticide substance is not equally efficacious against all parasites: a chemical having a very deleterious effect on lice may have practically no action on bed-bugs. Iodoform, which kills lice in ten to fifteen minutes, has practically no action on bed-bugs, which may live for more than twenty-four hours when exposed to it. It has also very little effect on fleas. Pyrethrum, on the other hand, has a much more powerful action on bed-bugs than on lice. It is useful, therefore, in preparing insecticide powders for general use, to mix various substances, some deleterious to lice, others to bed-bugs, and so on. A very good combined powder is naphthaline and pyrethrum in equal parts.

For use against lice on a large scale, as among troops or prisoners, perhaps the best insecticide powder is naphthaline. This substance has a lower licecide action than kerosene oil, guaiacol, iodoform, and anise preparations such as anethol, but it has a less unpleasant odour than the first three named, and is much cheaper than anethol powder. In stored blankets and clothing it is also practicable and of use, as frequently lice are found upon the clothing and blankets stored through the summer. Naphthaline is useful for its well-known deterrent action upon moths. As regards liquid insecticides, the American Sanitary Commission sanctioned the use of kerosene by using it daily for troops and prisoners.

For the better class of patients, in practice a menthol powder (menthol 3 to 5 gr., zinc. ox. 1 oz.) is to be preferred to naphthaline in most cases, as its odour is not unpleasant, while it is

repellent to mosquitoes in addition to lice and fleas. Such powder is especially useful in summer and in hot countries, as it has a cooling effect on the skin and often prevents prickly heat.

As regards ointments, we found the rather interesting and useful fact that plain vaseline has a powerful action on lice, and it is doubtful whether the addition of white precipitate and other chemicals increases its action. In practice, however, it is useful to add a small amount of white precipitate (3 gr. to 1 oz.), as it has a beneficial effect on secondary pyogenic infections, so common in persons infested with lice.

III.—Relapsing Fever.

Relapsing fever was extremely common in Serbia in 1915, in the spring and summer especially. It was not rare in 1916 among the Serbian troops in Corfu, after the retreat through Albania, and cases have been seen by me, again, in the Balkans this past winter. I would call attention to the comparative frequency of mixed infections which were seen in 1915—typhus exanthematicus + relapsing fever; malaria + relapsing fever. In Skopolje in 1915 it was extremely common to see relapsing fever develop in convalescents from typhus. The frequent co-existence of the two infections is probably explainable from their being carried by the same insect, the louse; though personally I am inclined to think that relapsing fever is carried also by bed-bugs.

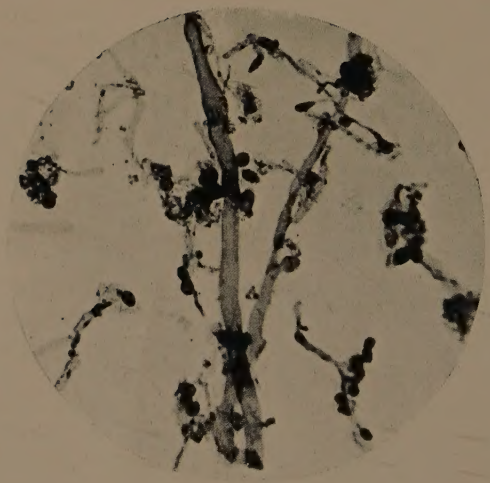
As regards the ætiology of the disease, as I hope to demonstrate in a future publication, I believe that in Europe, as in Africa, America, and Asia, it is due to several species of spirochætes, and not to one only (*Spirochæta recurrentis* Obermeyer). As regards clinical symptoms, I would point out how extremely difficult it is to diagnose from purely clinical symptoms, at the onset of the first attack, relapsing fever from typhus, malaria, and pappataci fever—only the microscope can help us.

IV.—Pappataci Fever.

This fever is extremely common in summer all over the Balkanic and Adriatic Zone. The so-called Uskub and Skopolje Fever, epidemics of which occur regularly every year in Skopolje and surrounding Macedonian districts, I found out in 1915 to be also Pappataci Fever. The disease, but for the rash, is very similar to Dengue as I have seen it in the Far East and Ceylon. It begins suddenly with rheumatoid pains all over the body, headache, pains in the eyeballs, fever (which seldom goes higher than 104°), no rigors. The face is flushed, and has often the appearance of being slightly bloated. The flushing is often so marked and

A

B



C

A.—*Oidium asteroides* Cast. Glucose-agar Culture.
B.—*Hemispora rugosa* Cast. Glucose-agar Culture.
C.—*Acladium Castellanii* Pinoy. Hanging Drop Culture.

Face p. 219.

severe as to amount to an erythematous rash, which often involves the neck. I would call attention to the appearance of the skin of the chest, and at times the abdomen, which shows frequently a delicate subcuticular mottling—cutis marmorata. The fever keeps high (102° to 104° F.) for thirty-four to forty-eight hours; it drops by crisis on the third day. Occasionally the fever lasts for four or five days, and may not drop so suddenly. At times some superficial lymphatic glands are enlarged.

V.—Other Tropical Diseases.

Next to malaria, the diarrhœas and dysenteries are the most common affections in the Balkans. Attention should be called to a type of diarrhœa seen in Serbian soldiers who had suffered terribly from starvation during the Albanian retreat. This diarrhœa closely resembled the famine diarrhœa observed in India.

So-called Camp Jaundice is common (*icterus castrensis*). According to my experience two varieties can be distinguished: (1) a very severe hæmorrhagic type with high fever lasting ten to twelve days, showing occasionally a relapse—true Weil's disease, rare; and (2) a mild type (*icterus castrensis levis*), often afebrile, very common. Weil's disease, as is well known, is of spirochætic origin, but in my opinion it is probable that many cases of the mild type are also spirochætic.

Fevers of the enteric group are fairly frequent in the Balkans, but during the last years have never assumed an epidemic type. Paratyphoid A and B are in certain districts more frequently met with than true typhoid.

With regard to the prophylaxis of these fevers I may perhaps be permitted to say that the method of combined vaccination I devised many years ago has given good results. It has recently been adopted in all the Allied Armies.

Of Malta Fever I have seen only two cases in Macedonia and the interior of the Balkanic Zone; it is more frequently met with on the coast and in the islands.

Kala Azar of adults I have never seen in the Balkans: of the infantile type I have seen many cases in certain islands of the Adriatic and Ægean Seas. It is rare in Macedonia, where I have seen only one case.

Bronchomycosis is common: I have seen cases of broncho-moniliasis, broncho-oidiosis, broncho-hemisporosis, aspergillosis, penicilliosis and nocardiasis. Bronchospirochætosis is not rare.

Pellagra is quite common in several districts of Macedonia, but I do not think there is any danger for the allied troops. I have seen a case of leprosy and a typical case of granuloma inguinale.

Of the tropical diseases which are of rarer occurrence, I may

mention Blackwater Fever, filariasis, sprue, intestinal myiasis, mycotic, spirochætic and flagellate urethritis.

Certain tropical skin diseases are frequently met with. The following are a cause of great discomfort in summer and are often wrongly diagnosed: dermatitis interdigitalis epidermophytica, or "mango toe"; tinea cruris or "dhobie itch"; prickly heat and various types of tropical pyosis—such as Pyosis Mansoni, pyosis discoides, etc. I have seen in 1915 in Macedonian peasants cases of ulcus tropicum, oriental sore, ulcus infantum, blastomycosis, sporotricosis, accladosis, etc.

The hour is late and I must conclude my lecture. From the experiences I have related it will be seen of what enormous importance microscopical organisms are in the ætiology of Tropical and War Zone diseases; what havoc they play in armies in the field; what ruin they can bring to a nation. Fortunately, thanks to the labours before and during the war of Roux, Sir Almroth Wright, Manson, Ross, Carrel, Browning, Horrock, Eyre, Martin, Simpson, Hewlett, and many others, a number of microbes have been dominated by new chemical or physiological methods, and some of them have been, so to speak, placed in harness and compelled to provide the means to prevent and cure the diseases of which they themselves are the cause: I mean vaccines and sera. The typhoid bacillus induces a disease which in previous wars has caused far more mortality than have bullets. The same bacillus by a very simple method has been turned into a beneficial vaccine which in this war has saved the lives of hundreds of thousands of brave soldiers in the British and Allied Armies.

Welch's bacillus is the common cause of that horrible infection, gas gangrene. By inoculating the same bacillus into animals a serum has been obtained which has both a preventive and a curative action.

The experience in the Balkanic War Zone has also shown more perhaps than anywhere else the paramount importance for diagnostic purposes and, indirectly for curative and prophylactic purposes, of the work in which all of you are interested; of the work which your Society has encouraged and furthered so much —namely, scientific microscopical work.

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